

The University of Chicago

THE CONODONT FAUNA OF THE
SEMINOLE FORMATION

A DISSERTATION SUBMITTED TO THE FACULTY
OF THE DIVISION OF THE PHYSICAL SCIENCES
IN CANDIDACY FOR THE DEGREE OF DOCTOR
OF PHILOSOPHY

DEPARTMENT OF GEOLOGY AND PALEONTOLOGY
1938

By
DANIEL JOHN JONES

Private Edition, Distributed by
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PREFACE

The study of the conodont fauna of the Seminole formation of north eastern Oklahoma, particularly in the vicinity of Collinsville, was begun by the writer in 1934. A preliminary report on the problem was submitted and accepted as a Master's thesis at the University of Oklahoma in 1935.

Since that time, however, much new information has been found concerning the paleontology, lithology, and stratigraphic relationships of the Seminole formation, as well as many new and significant facts concerning the conodonts and their morphological relationships. All of this new information has been added to the preliminary study and incorporated into this dissertation, which, it is believed, will throw some light on the much-debated query among paleontologists: "What is a conodont?"

ACKNOWLEDGMENTS

The writer desires to express his appreciation to Dr. Carey Croneis, associate professor of paleontology at the University of Chicago, for his most careful and constructive direction of this problem. To the members of the 1937 class in micropaleontology of the University of Chicago: Mr. W. R. Foster, Mrs. John D. Freeman, Mr. Arthur S. Gale, Jr., Mr. Leland Hörberg, Mr. W. F. Read, and Mr. Bruce Van Buren--thanks also is expressed for picking out and mounting numerous Seminole conodont specimens, and in finding several new and interesting individual forms. Mr. C. L. Cooper, of the Illinois Geological Survey made many helpful suggestions concerning the taxonomy and classification of the conodonts, and the naming of new species. To many other who, in some way have assisted in this study, either in the collection of samples, or in the laboratory, the writer is also grateful.

LABORATORY TECHNIQUE

In collecting the specimens for this study, and in preparing them for examination, the usual sample-washing and decantation technique was futile, for the conodonts were softer than their hard shale matrix; hence they crumbled to fine powder when the shale was crushed in the usual manner.

Accordingly, the black shale was brought in large slabs to the laboratory and split open in as large pieces as possible, in order to expose any assemblages present. Then the smaller fragments were split open with a razor blade along the fine laminations, and the fresh surfaces examined under a low-power microscope (Spencer Binocular with [12X] magnification). The conodonts were, with the exception of the Polygnathidae, left in the matrix, with enough of the shale removed with fine teasing needles to expose the entire outline and shape of the forms. The conodonts were then drawn to an enlargement of 30 diameters, the drawings mounted on plates, and photographed down to a plate size of 8 1/2 inches by 10 inches. The specimens themselves were mounted on regular one by three inch micropaleontological slides and deposited at Walker Museum of Paleontology of the University of Chicago.



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STRATIGRAPHY OF THE SEMINOLE FORMATION

The preliminary work on the geology and stratigraphy of the Pennsylvanian formations of northeastern Oklahoma has been revised in the past two years by a number of workers, who, after detailed field work in the area, have shown many new and significant facts concerning the age relationships of the conodont-bearing bed at Collinsville. In a recent paper on the cephalopod fauna of this horizon at Collinsville, A. K. Miller and J. B. Owen¹ published the following summary, prepared for them by Robert H. Dott and John M. Ware, of the Oklahoma Geological Survey:

The goniatite collections under consideration come from limy concretions occurring throughout a zone of black shale 5 feet seven inches thick, immediately overlying the Dawson coal, in strip pits in the S 1/2 sec. 32, T. 22 N., R. 14 E., near Collinsville, Oklahoma.

Concretions are commonly present throughout the outcrops of the black shale in this general vicinity, but they are only locally fossiliferous. . . . Essentially the same section is exposed near Dawson, Oklahoma, but there the concretions are reduced to mere nodules . . . barren of fossils.

On the geologic map of Oklahoma, compiled in 1923 by Hugh D. Miser, and published by the U. S. Geological Survey in 1926, the top of the Dawson coal is mapped as the top of the Nowata shale south of the city of Nowata. This procedure is in accord with the views of Ohern, who correlated the Dawson coal with the Lenapah limestone, which, by definition, marks the top of the Nowata shale. In northern Oklahoma, the Lenapah limestone is overlain by the Coffeyville formation, and, in accordance with the classification used on the state map, the goniatite-bearing beds at the Collinsville locality are the base of the Coffeyville, since they immediately overlie the Dawson coal.

The Lenapah limestone is now thought to be equivalent to a thin coquinoïd limestone which outcrops in the area between the towns of Mounds, and Collinsville, and, which, in the vicinity of Collinsville, occurs approximately 180 feet below the top of the Dawson coal. The typical Des Moines genera Mesolobus and Prismopora are common both in the Lenapah and its southern equivalent.

Recent field work has shown that the Dawson coal lies in the middle of the Seminole formation. In the vicinity of Collinsville, this formation is composed of three members,--a lower sandstone, a middle shale containing the Dawson coal, and

¹A. K. Miller, and John B. Owen, "A New Pennsylvanian Cephalopod Fauna from Oklahoma," Jour. Paleontology, Vol. XI (1937), p. 403.

an upper sandstone, all of which are well developed here.

On the basis of the revised correlations, the base of the Coffeyville formation is approximately 180 feet below the Dawson coal in the vicinity of Collinsville, and the Coffeyville contains the Seminole, together with 50 feet of underlying shale in its lower part. This places the goniatite-bearing beds 180 to 185 feet above the base of the Coffeyville rather than at its base.

It is in the goniatite-bearing zone described by Dott in the foregoing statement that the conodont fauna is found. Following is a detailed lithologic and paleontologic description of the section of the Seminole as exposed in the various strip pits in the vicinity of Collinsville:

Upper massive, contorted sandstone, buff-colored, ripple marked, containing numerous worm burrows 6 ft.

Dark blue-gray, massive calcareous shale, with Fistulipora, Septopora, Michelinea, Lophophyllum, Dictyoclostus, Juresania, Aviculopecten, Edmondia, Nuculopsis, Reticularia, Griffithides, in addition to numerous crinoid remains 12 ft.

Thin-bedded, platy, micaceous gray shale, with fragmentary plant remains and numerous ostracods (Jonesina) 8 ft.

Hard, dense, blue gray sandy limestone, with Ambocoelia planiconvexa, large turbinate gastropods, and shark teeth 1 ft.

Black, dense "box slate," with goniatite-bearing limy concretions containing also Michelinia eugeneae, Leiorhynchus rockymontana, Derbya crassa, and Marginigera muricata. This is the conodont horizon 5 ft.

Thin-bedded, gray calcareous shale, with pyritized fossils including Leiorhynchus rockymontana, Wellerella osagensis, Schizostoma catilloides, Nuculopsis ventricosa, Edmondia ovata, and numerous plant remains 1/2 ft.

Dawson coal 3 ft.

TERMINOLOGY OF CONODONTS USED IN THIS STUDY

ABORAL- the lower side of a conodont, usually recognized by the groove and/or pulp cavity and by the absence of denticles, cusps or nodal ornamentation.

ANTERIOR- this term, applied to heterognathid conodonts, refers to the downward bent portion of the bar; in the polygnathids, it refers to the end constituted by the plate.

- ANTERIOR DEFLECTION- the sharply deflected downward portion of the bar in such heterognathid forms as Falcodus and Angulodus.
- ANTICUSP- the downwardly projecting anterior portion of the heterognathid conodont forms.
- BAR- the horizontal, thickened element to which the denticles are affixed in the Heterognathidae; it may be straight, arched, curved or bent sharply at an angle.
- BLADE- the posterior, slender, bar-like portion of the Polygnathidae, usually smooth aborally and bearing a serrate ridge of fused denticles on its oral edge.
- CARINAE- long ridge running down the median line of the plate on the oral surface of polygnathid conodonts.
- CUSP- the largest in a series of denticles; it is found in the heterognathid forms, and is the essential element of the dental unit in the Progognathidae.
- DENTICLES- small tooth like units, usually arranged on a basal bar, smaller than the cusp, and varying greatly in shape, size, and cross-section.
- DISCRETE- referring to the condition of the denticles when they are not fused along their lateral edges, especially in the Heterognathidae.
- ESCUTCHEON- the aboral excavation, referred to also as the pulp cavity, basal expansion, and pit, lying beneath the cusp on progognathid forms (aborally) and heterognathid forms, and beneath the plate in the case of the polygnathids.
- KEEL- long ridge running anteriorly from the escutcheon on the aboral side of polygnathid forms.
- LATERAL RIDGE- basal thickening of the bar in heterognathid forms, running essentially parallel to the aboral edge of the bar.
- ORAL- the upper side of a conodont, or the side facing the interior of the mouth, characterized by presence of denticles, nodes, cusps, and other ornamentation.
- PLATE- the broadly expanded, thickened, orally ornamented anterior end of a polygnathid conodont.

THE PHYLOGENETIC RELATIONSHIPS OF CONODONTS

Conodonts are, upon the basis of present knowledge, confined to Paleozoic strata. They range from the lower Cambrian to the lower Permian. Although they occur in sandstones, shales and limestones, they are best preserved in black shales, such as the Ohio shale, Sunbury shale, Chattanooga shale, and the numerous black shales of the Pennsylvanian Coal Measures rocks.

Since their discovery by Pander,¹ in 1856, many workers have expressed many and varied opinions concerning their zoölogical relationships. Pander described the forms from the Ordovician and Silurian of Baltic Russia to primitive fishes closely allied to the Selachia.

Harley,² in 1861, describing conodonts associated with the Crustacean fauna of the Ludlow bone beds of Great Britain, concluded that they were spines attached to the caudal end of Squilla, Limulus, and other similar crustacean types.

In 1861, Owen,³ in his textbook of paleontology, reviewed all the work on conodonts up to that time, and concluded that they were probably the remains of annelid jaws or hooklets.

Newberry⁴ writing in the Ohio Geological survey Report for 1876, concluded that the conodonts occurring in the Carboniferous of Ohio were the teeth of elasmobranchs, while, at the same time Professor Louis Agassiz pronounced them, in a verbal statement, to be the teeth of selachians.

Hinde,⁵ in 1879, made a detailed study of conodonts from the Silurian and Devonian of the Upper Mississippi Valley, and of England. In the course of his study of the forms, he submitted his specimens to Professor Thomas Huxley, who expressed the opinion "that some of them so closely resemble the teeth of the Myxinioids (Hagfish), that it would be difficult to prove that they did not belong to this order."

Von Rohon and Zittel,⁶ in 1886, made microscopic examinations of the structure of conodonts, and pronounced them wholly

¹C. H. Pander, Monographie der Fossilen Fische des Silurischen Systems der Russisch-Baltischen Gouvernements (St. Petersburg, 1856).

²J. Harley, "On the Ludlow Bone-bed and its Crustacean Remains," Q.J.G.S. London, Vol. XVII (1861), pp. 543-552.

³Richard Owen, Paleontology (2d. ed.; Edinburgh, 1861), p. 17.

⁴J. S. Newberry, "Descriptions of Fossil Fishes," Ohio. Geol. Sur. Rept. Vol. II. Paleontology (1875), pp. 41-44, pl. 57.

⁵G. J. Hinde, "On Annelid Jaws from the Wenlock and Ludlow Formations of the West of England," Q.J.G.S. London, Vol. XXXVI (1879), pp. 368-378, pl. 14.

⁶J. V. Rohon, and Karl von Zittel, Akd. Wss. Muenchen Math-Phys. Class, Sitzunger, Band XVI (1886), pp. 108-116, pls. 1-2.

unlike the teeth of any of the fishes, mollusca, or crustaceans, and stated they resembled very closely the teeth of certain of the annelids, and of the Gephyreae. This theory was generally accepted by paleontologists of that time. In his textbook on paleontology, Zittel treats the conodonts as a footnote under the Cyclostomata.

In 1884, U. P. James¹ suggested that the conodonts were teeth from the radulae, or lingual ribbons of the gastropods.

Ulrich and Bassler,² in 1926, published the first comprehensive study of these peculiar microscopic fossils. This paper, establishing many of the accepted genera of conodonts, is considered authoritative by workers on the conodonts. Ulrich and Bassler considered conodonts as belonging to the fishes.

After the work by Ulrich and Bassler, numerous papers appeared in the literature between the years 1926 and 1934; chief among them were: (1) Stauffer and Plummer,³ writing on forms from the Pennsylvanian of Texas (2) Gunnell's study of the Pennsylvanian forms of Missouri,⁴ (3) Branson and Mehl's conodont studies on the forms of the older Paleozoic rocks of the United States,⁵ (4) the two papers by Cooper⁶ on the conodonts of the Arkansas novaculite, Chattanooga, Ohio, and Sunbury shales; (5) Huddle's report on the prolific fauna of the New Albany shale of Indiana;⁷ (6) Stauffer's

¹U. P. James, in Jour. Cincinnati Soc. Nat. Hist., Vol. VII (1884), pp. 143-49, pl. 7.

²E. O. Ulrich, and R. S. Bassler, "A Classification of the Tooth-like Fossils, Conodonts, with Descriptions of American Devonian and Mississippian Species," Proc. U.S. Nat. Mus., Vol. LXVIII (1926), pp. 1-63, pls. 1-11.

³C.R. Stauffer, and H. J. Plummer, "Pennsylvanian Conodonts of Texas," Univ. of Texas Bull. 3201 (1932), pp. 18-50, pls. 1-4.

⁴Frank H. Gunnell, "Conodonts and Fish Remains from the Cherokee, Kansas City, and Wabaunsee Groups of Kansas and Missouri," Jour. Paleo., Vol. VII, No. 3 (1933), pp. 261-98, pls. 29-31.

⁵E. B. Branson, and M. G. Mehl, "Conodont Studies," Univ. of Mo. Studies (1933), Nos. 1-4.

⁶C. L. Cooper, "Conodonts from the Arkansas Novaculite, Woodford Formation, and Ohio and Sunbury Shales," Jour. Paleo., Vol. V (1931), pp. 143-151; "Conodonts from the Upper and Middle Arkansas Novaculite, Mississippian, from Caddo Gap, Arkansas," Jour. Paleo., Vol. IX (1935), pp. 307-315.

⁷J. W. Huddle, "Conodonts of the New Albany Shale of Indiana," Bull. Americ. Paleontology (1934).

papers on the faunas of the Decorah¹ and Glenwood² beds of Iowa (7) Roundy's description of the conodonts of the Mississippian from San Saba County, Texas.³

In 1934, Schmidt⁴ published a paper on the occurrence of conodont assemblage from the Carboniferous of Germany. Also in the same year, H. W. Scott⁵ in describing the fauna of the Quadrant shales in the Mississippian of Montana, discussed and figured numerous conodont assemblages.

The study of the conodont fauna of the Seminole formation has led the writer to certain conclusions concerning them. These conclusions are based upon the study of both the individual conodonts and the assemblages. They are as follows, briefly:

(1) the four definite types of conodont assemblages represent four different types of animals possessing a rather complex oral apparatus.

(2) The careful examination of the 75 assemblages collected has shown that, in every case, these assemblages, which are by far too common and repetitious to be fortuitous, represent various stages in the process of dissociation of the original jaw apparatus; this process begins with the few almost perfect assemblages found and ends with the individual conodont.

(3) The absence of any other fossil remains in the immediate vicinity of any one of the assemblages points to the conclusion that the animal possessing the jaw apparatus had no other hard parts. Certainly, if the form did possess other parts of suitable nature for preservation, they would have been recorded in the extremely fine-grained black shales of the portion of the Seminole under discussion.

(4) The repeated occurrence of paired forms curving toward each other certainly suggests an original arrangement of the dental units around a buccal cavity of some sort.

(5) Among the hundreds of individual conodonts and assemblages occurring in the Seminole, no specimens were found showing any wearing or rounding off of either cusps or denticles;

¹C. R. Stauffer, "The Conodonts of the Decorah Shale," Jour. Paleo., Vol. IX (1935), pp. 596-620.

²C. R. Stauffer, "The Conodont Fauna of the Glenwood Beds," Bull. G.S.A., Vol. XLVI (1935).

³P. V. Roundy, "The Microfauna in the Mississippian Formations of San Saba County, Texas," U.S.G.S.P.P. 146 (1926), pp.5-16.

⁴Herman Schmidt, "Conodonten-Funde in ursprünglichen Zusammenhang," Paleontologische Zeitschrift, Band XVI (1935), No. 1.

⁵H. W. Scott, "Zoölogical Relationships of the Conodonts," Jour. Paleo., Vol. VIII, No. 4, pp. 448-455.

nor in the case of the Polygnathidae were the nodes or ridges worn. On the other hand, the most acutely pointed and delicate of the denticles of such forms as Hamulosodina are perfectly preserved.

(6) The writer concludes, after carefully considering all the evidence and suggestions furnished by the conodont fauna of the Seminole shale, that the most plausible zoölogical affinity of the Pennsylvanian conodonts as represented by the Seminole fauna lies with some extinct group of Paleozoic annelids or worm-like forms. If a bit of speculation might be permitted, he would also like to suggest that the forms bearing these assemblages possibly used them for grasping soft foods and retaining them in the anterior portion of the digestive tract while the powerful juices of the digestive system accomplished the transformation of the food into an assimilated product.

NOTES ON A PROPOSED SIMPLE CLASSIFICATION OF CONODONTS

The fact that conodonts are being found in more and more horizons in the sandstones, shales and limestones of the Paleozoic, together with the wide diversity in shapes and sizes of these peculiar microfossils, has led many students to realize their importance as stratigraphic markers for differentiation of many horizons. Recent work by Scott,¹ Schmidt² and the writer on the phylogenetic relationships and morphology of the conodonts has shown that the individual conodont is not the morphological unit of these forms, but that the assemblage, or natural grouping of them together in situ in the rock is the workable unit in this phase of their study.

However, since these assemblages have thus far been found to occur in only a few scattered zones throughout the Paleozoic, and, since the preponderance of systematic descriptions of these forms are based upon the individual conodonts, the writer considers it advisable to leave the present system in use for the paleontologist who employs the conodonts in stratigraphic work.

In examining the literature on conodonts in the course of the study of the Seminole fauna, the writer observed that all conodonts thus far described might well be grouped into three rather broad units or groups, each having certain characteristics. The first of these--the Protognathidae--are characterized by one large cusp, with or without small auxiliary denticles, mounted on a circular or sub-circular base. This group would include such forms

¹Scott, op. cit.

²Schmidt, op. cit.

as Acodus, Drepanodus, and Pteroconus. Generic differences within this group should be based on presence of auxiliary denticles, size and shape of cusp, and presence or absence of pulp cavities on the aboral side.

The second group, designated the Heterognathidae, possess a basal bar, more or less elongate, upon which are arranged a linear series of denticles, varying in size and shape. Into this group fall such forms as Bryantodus, Euprionioidina, Hamulosodina, and Lonchodina. Generic differences within the Heterognathidae would be based upon curvature of the bar, presence of cusp and anticusp, nature and size of denticles mounted on the bar, and the presence or absence of a pulp cavity. The third group has been in use for some time,--the Polygnathidae--which include all compound forms possessing a thickened anterior lanceolate plate, and a posterior long, slender denticulated blade. To this group have been assigned such forms as Polygnathus, Streptognathodus, and Gondolella. Following is an experimental grouping of the known genera of conodonts under the three headings previously listed. Naturally, there occur numerous borderline forms, particularly forms which may fit either into the Protognathidae or the Heterognathidae.

PROTOGNATHIDAE

Simple dental units, consisting of one large cusp, with or without small accessory denticles, mounted on a circular or sub-circular base.

GENUS	NOMENCLATOR	YEAR
<u>Acodus</u>	Pander	1856
<u>Acontiodus</u>	Pander	1856
<u>Belodus</u>	Pander	1856
<u>Cordylodus</u>	Pander	1856
<u>Cornuramia</u>	Smith	1907
<u>Distacodus</u>	Hinde	1879
<u>Drepanodus</u>	Pander	1856
<u>Erismodus</u>	Branson and Mehl	1933
<u>Fortscottella</u>	Gunnell	1931
<u>Ichthyodus</u>	Harris and Hollingsworth	1933
<u>Idioproniodus</u>	Gunnell	1933
<u>Lepodus</u>	Branson and Mehl	1933
<u>Microcoelodus</u>	Branson and Mehl	1933
<u>Oistodus</u>	Pander	1856
<u>Paltodus</u>	Pander	1856
<u>Polycaulodus</u>	Branson and Mehl	1933
<u>Pteroconus</u>	Branson and Mehl	1933
<u>Scolopodeella</u>	Stauffer and Plummer	1932

GENUS	NOMENCLATOR	YEAR
<u>Scolopodus</u>	Pander	1856
<u>Stereoconus</u>	Branson and Mehl	1933
<u>Trichognathus</u>	Branson and Mehl	1933

HETEROGNATHIDAE

<u>Ambalodus</u>	Branson and Mehl	1933
<u>Angulodus</u>	Huddle	1934
<u>Apatognathus</u>	Branson and Mehl	1933
<u>Barbarodina</u>	Stauffer	1935
<u>Bicornognathus</u>	Jones	1938
<u>Bryantodina</u>	Stauffer	1935
<u>Bryantodus</u>	Ulrich and Bassler	1926
<u>Cardiodus</u>	Branson and Mehl	1933
<u>Centrognathus</u>	Branson and Mehl	1933
<u>Chirognathus</u>	Branson and Mehl	1933
<u>Coleodus</u>	Branson and Mehl	1933
<u>Ctenognathus</u>	Pander	1856
<u>Curtognathus</u>	Branson and Mehl	1933
<u>Cyrtoniodus</u>	Stauffer	1935
<u>Dichognathus</u>	Branson and Mehl	1933
<u>Diplododella</u>	Ulrich and Bassler	1926
<u>Eurprioniodella</u>	Jones	1938
<u>Euprioniodina</u>	Ulrich and Bassler	1926
<u>Falcodus</u>	Huddle	1934
<u>Gyrognathus</u>	Stauffer	1935
<u>Hamulosodina</u>	Cooper	1931
<u>Heterognathus</u>	Stauffer	1935
<u>Hibbardella</u>	Ulrich and Bassler	1926
<u>Hindeodella</u>	Ulrich and Bassler	1926
<u>Hindeodelloides</u>	Huddle	1934
<u>Ligonodina</u>	Ulrich and Bassler	1926
<u>Lonchodina</u>	Ulrich and Bassler	1926
<u>Lonchodus</u>	Pander	1856
<u>Metaprioniodus</u>	Huddle	1934
<u>Neocoleodus</u>	Branson and Mehl	1933
<u>Nothognathella</u>	Branson and Mehl	1933
<u>Oulodus</u>	Branson and Mehl	1933
<u>Oxygonus</u>	Grubb (Jones)	1938
<u>Ozarkodina</u>	Branson and Mehl	1933
<u>Pachysomia</u>	Smith	1907
<u>Palmatodella</u>	Ulrich and Bassler	1926
<u>Panderodella</u>	Ulrich and Bassler	1926
<u>Phragmodus</u>	Branson and Mehl	1933
<u>Pinacodus</u>	Branson and Mehl	1933
<u>Plectodina</u>	Stauffer	1935
<u>Plectospathodus</u>	Branson and Mehl	1933
<u>Polygnathellus</u>	Ulrich and Bassler	1926
<u>Prioniodella</u>	Ulrich and Bassler	1926
<u>Prioniodina</u>	Ulrich and Bassler	1926
<u>Prioniodus</u>	Pander	1856
<u>Prionognathus</u>	Pander	1856
<u>Solenognathus</u>	Branson and Mehl	1933
<u>Subbryantodus</u>	Branson and Mehl	1933
<u>Subcordylodus</u>	Stauffer	1935

GENUS	NOMENCLATOR	YEAR
<u>Synprioniodina</u>	Ulrich and Bassler	1926
<u>Telumodina</u>	Cooper	1931
<u>Tortoniodus</u>	Stauffer	1935
<u>Trucherognathus</u>	Branson and Mehl	1933

POLYGNATHIDAE

Compound dental units consisting of an anterior plate and posterior bar which continues orally onto the surface of the plate; aboral escutcheon usually present; oral surface of plate variously ornamented with carinae, nodes, and denticles

GENUS	NOMENCLATOR	YEAR
<u>Amorphognathus</u>	Branson and Mehl	1933
<u>Ancyrodella</u>	Ulrich and Bassler	1926
<u>Ancyrognathus</u>	Branson and Mehl	1933
<u>Bicarinodus</u>	Jones	1938
<u>Cavusgnathus</u>	Harris and Hollingsworth	1933
<u>Gnathodus</u>	Pander	1856
<u>Gondolella</u>	Stauffer and Plummer	1932
<u>Icriodus</u>	Branson and Mehl	1933
<u>Idiognathoides</u>	Harris and Hollingsworth	1933
<u>Idiognathodus</u>	Gunnell	1931
<u>Palmatolepis</u>	Ulrich and Bassler	1926
<u>Polygnathoides</u>	Branson and Mehl	1933
<u>Polygnathus</u>	Hinde (Bryant)	1879 (1921)
<u>Polylophodonta</u>	Branson and Mehl	1933
<u>Polyplacognathus</u>	Stauffer	1935
<u>Pseudopolygnathus</u>	Branson and Mehl	1933
<u>Scyphiodus</u>	Stauffer	1935
<u>Siphonognathus</u>	Branson and Mehl	1933
<u>Spathodus</u>	Branson and Mehl	1933
<u>Streptognathodus</u>	Stauffer and Plummer	1932

The foregoing classification of the conodonts is entirely tentative, and is merely suggested in order to simplify the taxonomic work with conodonts; the writer is at present working on a key to the identification of conodont genera, based upon the classification suggested here.

SYSTEMATIC DESCRIPTIONS OF ASSEMBLAGES

In addition to the large variety of individual conodonts occurring in the Seminole formation, there were also found numerous groupings or assemblages of individual conodonts, associated together in situ in the rock. The manner of their grouping, with a definite plan or scheme of alignment of the component individuals, suggests that they were all parts of a morphological unit or

apparatus of some form of life.

Moreover, the large number of assemblages examined brings out the fact that there exist in the Seminole horizon definite types of associations, each containing its characteristic genera and species of conodonts. For purposes of convenience, the type of assemblage will be here designated by the characteristic polygnathid conodont found in that assemblage.

The Streptognathodus type: Assemblages usually consisting of four or six specimens of Hamulosodina arranged either in two or three pairs, lying with their bars parallel, and denticles all sloping in the same direction, pointing toward a common central axis. Lying adjacent to these are generally found two specimens of the same species of Bryantodus, with their bars lying parallel, and with the inner side of one next to the inner side of the other, suggesting their original positions on either side of a buccal cavity of some sort. There are also usually present two specimens of the same species of Streptognathodus, with the oral surface of one lying in juxtaposition to the aboral surface of the other. The anterior plate of the one is in juxtaposition to the posterior blade of the other.

The Gondolella type: Assemblages usually consisting of one or two pairs of the same species of Euprioniodina, with their inner surfaces lying in juxtaposition. One or two pairs of the same species of Lonchodina are also found in most cases of this type. The polygnathids in these assemblages are Gondolellas, occurring as a pair, with their long axes essentially parallel, one specimen with its oral side up, the other with its aboral side up.

The Bicarinodus type: Assemblages consisting usually of two pairs of the same species of Hamulosodina, lying with their bars essentially parallel, and two specimens of the same species of Bryantodus, with their inner sides in juxtaposition. The polygnathids in this type are the peculiar genus Bicarinodus, usually represented by one pair of the same species.

The Oxygonus type: In assemblages grouped under this type, no recognizable polygnathid has thus far been observed. These assemblages, however, greatly resemble the Bicarinodus groupings in that the specimens of Bryantodus and Hamulosodina present are so similar. In addition to the usual two pairs of Hamulosodina, and the one pair of Bryantodus, there are usually two specimens of the same species of Oxygonus. These forms are usually situated with

their long axes parallel, and they curve towards each other anteriorly.

ASSEMBLAGE ONE

Plate IV, Figure 1

This peculiar assemblage does not fit into any of the previously described groups of conodont assemblages, but, from the general appearance of the heterognathid forms present, it is probably referable to the Gondolella type. Assemblage consists of two individuals of the same species of Lonchodus lying facing each other, and two more of the same species of Lonchodus lying essentially parallel to each other. Two specimens of a different species of Lonchodus are also present, together with two individuals of a species of Lonchodina, lying with the line of curvature pointing inward toward each other.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44601.

ASSEMBLAGE TWO

Plate IV, Figure 2

This grouping is a typical example of the Gondolella type of conodont assemblage. It consists of two specimens of the same species, Gondolella cuneiformis, lying parallel, with one lying oral side up, while the other, represented by a good clear imprint in the black shale, is lying with its aboral side up. Lying below these is a pair of an unidentifiable species of Lonchodus, lying with their bars and denticles parallel. Immediately below these are two individuals of Euprioniodina acuta, lying with their inner sides in juxtaposition, bars crossed.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.3.

Holotype: Walker Museum No. 44602.

ASSEMBLAGE THREE

Plate IV, Figure 3

This assemblage serves as a typical specimen of the Streptognathodus type. It consists of two pairs of the same species of Hamulosodina, with their bars parallel and denticles pointing inward and toward the posterior. Lying immediately adjacent is a pair of Bryantodus, with their inner sides toward each other, but with the denticles sloping in opposite directions. Lying just at

the anterior end of the Hamulosodinas is a pair of Streptognathodus with a peculiar orientation:--the anterior blade on one lies opposite the posterior blade of the other, and the oral surfaces face each other.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44603.

ASSEMBLAGE FOUR

Plate IV, Figure 4

This may be regarded as a typical assemblage of the Bicarinosodus type. It consists of two excellent pairs of Hamulosodina, one pair lying across the other pair, but with the denticles of one pair pointing toward the other, and all denticles sloping in the same direction--posteriorly. Two excellent specimens of the form Bicarinosodus typicus lie adjacent to each other, but with their anterior ends pointing in opposite directions. As in the previously described assemblages, two specimens of Bryantodus lie adjacent to the Bicarinosodus, with their inner sides toward each other, and with their denticles sloping in opposite directions.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 446014.

ASSEMBLAGE FIVE

Plate IV, Figure 5

This specimen, consisting of one Gondolella ovatus, one Euprioniodina longicuspata, and a pair of Lonchodus curvata, with one small extra fragment of Lonchodus, is regarded as a partially disintegrated specimen of the Gondolella type of assemblage.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44605.

ASSEMBLAGE SIX

Plate IV, Figure 6

This specimen may be regarded as a partially disintegrated assemblage. It consists of four specimens of Hamulosodina, three of which are lying essentially parallel, with their denticles sloping and pointing in the same direction. The fourth Hamulosodina lies below the others, crossing them, and its denticles point in the opposite direction. There are present two specimens of the genotype

of Oxygonus, one of which is complete and presents the convex side of its bar curvature up, while the corresponding specimen of Oxygonus lying below the first one presents the inner side of the bar curvature upward. The two specimens of Oxygonus are also pointing in opposite directions. There is also one specimen of Bryantodus present in this assemblage.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44606.

ASSEMBLAGE SEVEN

Plate IV, Figure 7

This grouping probably represents a more advanced stage in the disintegration of an assemblage. There are present only two specimens of Hamulosodina, lying parallel, with denticles pointing and sloping in the same direction--undoubtedly these are the right half of the complete Hamulosodina pairing observed in other assemblages. The polygnathid in this assemblage is Bicarinodus sp. . . .

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44607.

ASSEMBLAGE EIGHT

Plate IV, Figure 8

A much disintegrated form with three specimens of Hamulosodina two of which are pointing toward the third, which has its denticles pointing inward toward the other two. Between these is a specimen of Bicarinodus with its aboral side up.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44608.

ASSEMBLAGE NINE

Plate IV, Figure 9

This occurrence is significant in that it represents the only assemblage found in which the genus Prioniodus is represented. The assemblage consists of two specimens of Hamulosodina, their bars parallel, but with the denticles sloping in opposite directions. The specimen of Prioniodus lies at the anterior end of one of the Hamulosodinas, and the sweep of its cusp is in the same direction as the slope of the denticles of the Hamulosodina. It seems safe to suggest that such forms as Prioniodus were situated

in the extreme anterior portion of the oral assemblage.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44609.

ASSEMBLAGE TEN

Plate IV, Figure 10

A fragmentary, much disintegrated assemblage, consisting of two specimens of an unidentified species of Lonchodus, both with their bars lying essentially parallel, but with the denticles sloping in opposite directions.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44610.

ASSEMBLAGE ELEVEN

Plate IV, Figure 11

This fragmentary grouping of three specimens of the same species of Hamulosodina probably represents a much disintegrated remnant of a more complete assemblage. The absence of any polygnathid or other diagnostic conodont makes it impossible to assign it to any one of the assemblage types represented in the Seminole.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44611.

ASSEMBLAGE TWELVE

Plate IV, Figure 12

An occurrence of an apparently much dissociated assemblage, chosen for illustration of the very suggestive orientation of the two individuals of the same species of Oxygonus. It will be noted that the two bars lie essentially in the same position, but that the inner curving portions of the anterior ends of these two forms curve toward each other, as if they were arranged on either side of an oral cavity.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44612.

ASSEMBLAGE THIRTEEN

Plate IV, Figure 13

This symmetrical grouping of three pairs of Hamulosodina demonstrates what the writer believes to be the original orientation

of the individuals of this genus in a conodont assemblage. Three of the six face the other three, denticles pointing inward toward a common center, with denticles all sloping in the same direction.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44613.

ASSEMBLAGE FOURTEEN

Plate IV, Figure 14

An assemblage probably much dissociated, consisting of nothing but two specimens of Streptognathodus arranged with the aboral side of one facing the oral side of the other, and with the anterior end of one opposite the posterior end of the other.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.3.

Holotype: Walker Museum No. 44614.

ASSEMBLAGE FIFTEEN

Plate IV, Figure 15

This grouping is again a representative of what may be interpreted as a very advanced stage in the dissociation of a conodont assemblage. Only three conodonts remain--one, a specimen referred to Lonchodus erectus and the other two representing two species of Euprioniodina. This specimen has been provisionally assigned to the Gondolella type of conodont assemblage.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44615.

SYSTEMATIC DESCRIPTIONS OF INDIVIDUAL CONODONTS

Genus BICORNOGNATHUS Jones n. gen.

Large heterognathid conodonts, consisting of a basal bar abruptly recurved anteriorly similar to Euprioniodina, surmounted orally by two long sinuous cusps which are anterior and terminal, and by a series of posterior, discrete, slender denticles, eight or more in number. Denticles curve anteriorly and become more vertical to the bar posteriorly. Posterior edge of second cusp stem-like in outline due to fusion of two posterior denticles with it.

Genotype: Bicornognathus freemani Jones n. sp.

BICORNOGNATHIS FREEMANI Jones n. sp.

Bar short, medium thick, with no basal flange present. Oral

surface carrying eight long, slender discrete, slightly sinuous denticles which curve toward anterior end of bar, becoming more vertical to the bar posteriorly. Two terminal cusps present, subequal in size, and three times as long as the other denticles; the second of these two cusps is quite thickened in width due to the fusion of two smaller denticles posterior to it near the base, producing a double indentation in the outline of the posterior margin of the cusp; definite escutcheon or pulp cavity present beneath each of the cusps. This is the only species of Bicornognathus, but three good individuals of this species are in the collection.

Holotype: Walker Museum No. 44616.

Cusp Length: 1.57 mm. Bar Length: .75 mm. Av. Dent. Ht.: .6 mm.

Horizon: Seminole Formation; Collinsville, Oklahoma, Loc.1.

Genus BRYANTODUS Ulrich and Bassler 1926

Like Prioniodina, but denticles with sharp, laterally confluent edges. The main cusp is proportionately much longer, and, as a rule, much more conspicuous in its width, and with broadly expanded sides confluent with adjacent denticles. The base forms a narrow, flange-like expansion on both sides with a characteristic downward projection on the inner side beneath main cusp, serving perhaps for a securing attachment in the jaw of the animal. The denticles are connected by a membranous extension of their edges, a feature much better developed in this genus than in the otherwise related genus Prioniodina.

BRYANTODUS SEMINOLENSIS Jones n. sp.

Plate II, Figure 1

Bar thicker in anterior half, bent at an angle of 170 degrees near center of bar; anterior portion of bar carries orally eleven short, wide, obtusely pointed denticles, which increase slightly in length and become more slender toward the cusp. Cusp is large, fused with the anterior denticle adjacent to it, acutely pointed. Denticles posterior to cusp, only one-half length of cusp and alternate irregularly with larger ones, twelve in number. Well developed pulp cavity is present just beneath cusp.

Length of bar: 1.6 mm. Height of Cusp: 1.4 mm. Av. Dent. ht.: .5 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44617.

BRYANTODUS MAGNUS Jones n. sp.

Plate II, Figure 2.

Large form; bar long, slightly curved at a point one-third

distance from anterior end. Denticles anterior to cusp eleven in number, discrete, medium sized, obtusely pointed. Cusp sub-central long, no thicker than other denticles; denticles posterior to cusp nine in number, smaller, thicker, more discrete than those anterior. Escutcheon only slightly developed under main cusp. No basal flange present along bar.

Length of Bar: 1.9 mm. Ht. of Cusp: .46 mm. Av. Dent. Ht.: .28 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.1.
Holotype: Walker Museum No. 44618.

BRYANTODUS PSEUDOALTERNATA Jones n. sp.

Plate II, Figure 3

Medium-sized form, bar slender, slightly bent just anterior to the center, surmounted orally by six wide, flattened, short, obtusely pointed, discrete denticles anterior to cusp. Cusp larger, wider, and one-third longer than other denticles; flattened, elliptical in cross section, bearing one partially fused denticle on its posterior edge. Posterior portion of bar carrying orally seven larger, more broadly expanded denticles, increasing in slope posteriorly, with smaller germ denticles inserted between each of the last four large denticles.

Remarks: This form differs from B. seminolensis in the presence of the germ denticles which appear to alternate with the larger true posterior denticles.

Length: 1.18 mm. Cusp Ht: .21 mm. Av. Dent. Ht.: .17 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.2.

BRYANTODUS INCLINATUS Jones n. sp.

Plate II, Figure 4

Small form, bar bent sub-centrally at an angle of approximately 170 degrees; bar surmounted by eight small, partially discrete denticles anterior to cusp. Cusp larger by one-third than other denticles. Posterior portion of bar bearing nine denticles, which increase in size and in slope to the bar until the last two make an angle of 30 degrees with the bar; those denticles anterior to cusp stand almost 80 degrees to the bar. Pulp cavity present aborally beneath cusp.

Remarks: This new species was erected on the basis of the sudden change in the angle that the denticles make with the bar from anterior to posterior.

Length: .75 mm. Cusp Ht.: .31 mm. Av. Dent. Ht.: .13 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.1.
Holotype: Walker Museum No. 44620.

BRYANTODUS CRUVATA Jones n. sp.

Plate II, Figure 5

Medium-sized form: bar slightly bent near center, with both anterior and posterior ends rather sharply recurved downward; thick, with a basal flange. Bar surmounted orally in anterior portion by a series of twelve slender, short, pointed denticles. Cusp thicker, more obtusely pointed, and one-third longer than other denticles. Posterior denticles fifteen in number, subequal in length, almost vertical to bar. Escutcheon present on aboral side beneath cusp.

Remarks: This species differs from anything in the literature in the double curvature of the bar.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Length: 1.0 mm. Ht. of cusp: .39 mm. Av. Dent. Ht.: .21 mm.

Holotype: Walker Museum No. 44621.

BRYANTODUS ANGULARIS Jones n. sp.

Plate II, Figure 6

Bar bent sharply just posterior to center; basal portion thick, blade-like, surmounted orally by ten subequal, partially confluent denticles anterior to cusp. Cusp sharply pointed, almost one-third larger than other denticles, elliptical in cross section. Denticles posterior to bar nine in number, sloping more to the bar, thicker and shorter than those in anterior portion. Pulp cavity present just beneath cusp at base of bar, which is thicker in anterior portion.

Length: 1.0 mm. Ht. of Cusp: .25 mm. Av. Dent. Ht.: .14 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.

Holotype: Walker Museum No. 44622.

BRYANTODUS MULTIDENTATA Jones n. sp.

Plate II, Figure 7

Large form; bar thick, curved slightly at one-third its length. Bar surmounted orally by ten long slender, partially fused, acutely pointed denticles anterior to cusp. Cusp slightly larger and more acutely pointed. Posterior portion of bar carrying orally thirteen more slender, confluent denticles, which increase slightly in slope to the bar at the posterior end.

Length: 1.3 mm. Height of Cusp: .40 mm. Av. Dent. Ht.: .25 mm.

Horizon: Seminole formation, Collinsville, Oklahoma, Loc.2.
Holotype: Walker Museum No. 44623.

BRYANTODUS PSEUDOREGULARIS Jones n. sp.

Plate II, Figure 8

Large form; bar abruptly curved at an angle of 160 degrees. Bar carrying on its oral surface a series of thirteen to fifteen long, slender, acutely pointed denticles, which are confluent for the greater part of their length. Cusp large, sub-central, almost three times as broad as denticles. Denticles posterior to cusp subequal in length, wider than those in anterior portion, thirteen in number. Definite escutcheon present aborally just beneath cusp.

Remarks: This form is assigned to a new specific rank because of the almost equal division of denticles anterior to and posterior to the cusp. The form also is characterized by the subequal nature of the denticles.

Length: 1.18 mm. Height of cusp: .45 mm. Av. Dent. Ht.: .35 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

BRYANTODUS SYMMETRICUS Jones n. sp.

Plate II, Figure 10

Medium sized form; bar slender, thin, no basal flange present, bent centrally at an angle of approximately 140 degrees. Bar surmounted in anterior portion by a series of eleven denticles, the first four of which are long, slender and acutely pointed, followed by a small germ denticle; this is in turn followed by five more long, slender denticles. Cusp slightly larger than anterior denticles, heavier, and more flattened; posterior denticles eleven in number, shorter, and sloping toward the posterior end. There is present a definite aboral escutcheon beneath the cusp.

Length: 1.5 mm. Height of cusp: .41 mm. Av. Dent. Ht.: .31 mm.

Horizon: Seminole formation: Collinsville, Oklahoma. Loc.3.
Holotype: Walker Museum No. 44625.

BRYANTODUS ALTERNATUS Jones n. sp.

Plate II, Figure 8

Large form; bent slightly in sub-central position. Bar thick, possessing a basal flange for the greater part of its length. Anterior portion of bar possessing eleven subequal, partially discrete denticles, acutely pointed. Cusp region occupied by one large cusp-like denticle and two smaller, subequal denticles posterior to it. Posterior denticles smaller, alternating with even smaller denticles; there are ten large posterior denticles and nine interrelated smaller ones. Pulp cavity well developed beneath cusp and the two adjacent posterior denticles.

Remarks: This form has been given a new specific name because of the peculiar alternation of large and small denticles in such a regular fashion posterior to the cusp region.

Length: 1.8 mm. Height of Cusp: .9 mm. Av. Dent. Ht.: .31 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.

Holotype: Walker Museum No. 44626.

BRYANTODUS PARVA Jones. n. sp.

Extremely small, simple form. Bar short, no basal flange present, bent sub-centrally at an angle of about 150 degrees. Bar surmounted in anterior portion by five short, discrete, broadly expanded denticles, which are somewhat flattened. The cusp is only slightly larger than the denticles, and occurs in sub-central position. The posterior denticles, six in number, the first of which is a germ denticle; the remaining five are larger, more broadly expanded, discrete denticles increasing in slope posteriorly.

Length: .7 mm. Height of Cusp: .56 mm. Va. Dent. Ht.: .36 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44627.

BRYANTODUS ALTAX Jones n. sp.

Plate II, Figure 12

Medium sized form; bar exceptionally thick, with well developed basal flange and pulp cavity. Surmounted orally by ten anterior, long, slender, confluent denticles, subequal in length

and width. Cusp one-third larger than other denticles, sub-central in position, its lateral edges confluent with the immediately adjacent denticles on either side. Denticles posterior to cusp shorter, wider, more discrete, fourteen in number.

Remarks: This form differs from the other species of Bryantodus in that the bar is much thicker, the denticles are more confluent, and much longer in proportion to the length of the bar.

Length: 1.3 mm. Height of Cusp: .61 mm. Av. Dent. Ht.: .43 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.
Holotype: Walker Museum No. 44628.

Genus EUPRIONIODINA Ulrich and Bassler

This genus is very much like Prioniodina, but the main cusp is much more produced, and the anterior of the bar smaller, more sharply deflected, and carries on its oral side a number of closely arranged denticles.

EUPRIONIODINA LACTICOMPRESSA Jones n. sp.

Plate III, Figure 13

Small, laterally compressed form; bar acutely recurved anteriorly, thick, cusp very large, long, produced to a sharp point; anterior two denticles parallel to cusp, though much shorter; posterior seven denticles very long, discrete, and slender. Escutcheon present beneath cusp.

Remarks: This species of Euprioniodina is characterized by the very abrupt curvature of the anterior portion of the bar, appearing to be compressed laterally. No such form has been seen by the writer in the literature.

Length: .31 mm. Height of cusp: .68 mm. Av. Dent. Ht.: .42 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.3.
Holotype: Walker Museum No. 44629.

EUPRIONIODINA RECTA Jones n. sp.

Plate II, Figure 14

Extremely large form; bar essentially straight, abruptly recurved at anterior end at an angle of 120 degrees; oral surface bearing three small, confluent denticles anterior to cusp. Cusp long, slender, acutely pointed, followed posteriorly by 24 large,

partially discrete, subequal denticles. Basal flare of escutcheon present near base of cusp.

Remarks: This form resembles no species of Euprioniodina which has been brought to the writer's attention. The specific characteristics marking this form are the large number of posterior denticles, the linear nature of the bar posterior to the hook and the anterior end.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44630.

EUPRIONIODIAN ACUTA Jones n. sp.

Plate II, Figure 15

Medium sized form; bar curved abruptly at anterior end at an angle of 80 degrees; anterior portion bearing three short subequal, partially discrete denticles. Cusp very long, acutely pointed; posterior portion of bar carrying eleven discrete, long, acutely pointed denticles, which increase in size and verticality toward the posterior. Escutcheon slightly developed.

Remarks: This form is characterized by its acutely pointed, tapering denticles; it differs from E. laticompressa in the fact that it does not appear compressed laterally, and from E. fragilis and E. equalis in its size.

Length: .85mm. Length of cusp: .48 mm. Av. Dent. Ht.: .27 mm.

Horizon: Seminole formation, Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44361.

EUPRIONIODINA FRAGILIS Jones n. sp.

Plate II, Figure 16

Small, fragile dental unit; bar curving abruptly at anterior end, recurved; basal flange present throughout length of bar. Anterior denticles small, three in number. Cusp abnormally wide at base, tapering rapidly to a long, produced sharp point. Posterior denticles discrete, long, slender, nine in number, increasing in slope posteriorly. No escutcheon is visible. The entire surface is minutely granulose.

Remarks: This form is the most delicate of all species of this genus found in the Seminole. It is much more fragile looking than any described forms which the writer has observed. Also, the

broadly expanded base of the cusp in this form is characteristic.
 Length: .4mm. Height of cusp: .25 mm. Av. Dent. Ht.: .19 mm.
 Horizon: Seminole formation; Collinsville, Oklahoma. Loc. 3.
 Holotype: Walker Museum No. 44362.

EUPRIONIODINA CRONEISI Jones n. sp.

Plate II, Figure 17

Medium sized form; bar V-shaped, limbs of bar meeting at an angle of 50 degrees. No definite cusp is present. Oral surface of bar surmounted by 21 short, obtusely pointed, inclined denticles, which are flattened in cross section. Height of form is equal to width across the bar.

Remarks: This interesting form is named in honor of Dr. Carey Croneis, who so ably directed this thesis problem.

Length: .5 mm. Height of denticles: .19 mm.

Horizon: Seminole formation, Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44363.

EUPRIONIODINA EQUILATERALIS Jones n. sp.

Plate II, Figure 18

Medium sized form; bar V-shaped; limbs of bar meeting at an angle of 70 degrees. Cusp central, straight, discrete, tapering to a moderately sharp point; oral surface of bar carrying four subequal denticles on each side of cusp, denticles lie parallel to cusp.

Remarks: This form differs from E. croneisi in the development of the main cusp, and from E. coronata (Stauffer and Plummer) in its greater development of symmetry.

Length: .4 mm. Height of cusp: .45 mm. Av. Dent. Ht.: .3 mm.

Horizon: Seminole formation, Collinsville, Oklahoma. Loc.3.

Holotype: Walker Museum No. 44634.

EUPRIONIODINA SUBEQUALIS Jones n. sp.

Plate II, Figure 19

Medium sized form; bar curved anteriorly; basal flange present. Oral surface bearing three subequal small denticles anterior to cusp. Cusp long, slender, discrete, acutely pointed.

Posterior denticles eight in number, increasing in verticality and becoming slightly curved posteriorly.

Remarks: This form differs from E. acuta in the less abrupt curvature of the anterior end of the bar, and in the more equal length of the posterior denticles.

Length of Bar: .54 mm. Height of Cusp: .47 mm. Av. Dent. Ht.: .28 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.
Holotype: Walker Museum No. 44635.

EUPRIONIODINA COLLINSVILLENSIS Jones n. sp.

Plate I, Figure 9

Small dental unit; bar short, thick, curved somewhat abruptly at anterior end. Bar bears anteriorly three small, unequal, discrete denticles. Cusp long, rather broadly expanded at base, pointing anteriorly; posterior denticles large, discrete, broadly expanded at their bases, acutely pointed, six in number, increasing in verticality to the bar at posterior end.

Remarks: This species was reported found by Grubb¹ in the roof shales overlying coal No. 8 of the Trivoli cyclothem of the Pennsylvanian of Illinois.

Length: .55 mm. Ht. of Cusp: .56 mm. Av. Dent. Ht.: 37 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.
Holotype: Walker Museum No. 44636.

EUPRIONIODINA LONGICUSPATA Jones n. sp.

Plate I, Figure 10

Medium-sized form; bar short, with basal flange present; bears on oral side two small, confluent, denticles lying parallel to cusp. Cusp extremely long, slender, produced into a very acute point. Posterior denticles discrete, rather long and slender, but only half the length of the cusp; six in number, increasing in verticality toward the posterior.

Remarks: This species of Euprioniodina differs from the previously described E. laticompressa in the unusual development of the cusp, and in its slight lateral compression.

¹Carl E. Grubb, "Conodonts from Coal Measures of Illinois" (Unpublished Master's thesis, University of Illinois, 1932).

Length: .45 mm. Height of Cusp: 1.3 mm. Av. Dent. Ht.: .34 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.
Holotype: Walker Museum No. 44637.

EUPRIONIODINA SCOTTI Jones n. sp.

Plate I, Figure 14

Small form; bar V-shaped, with small base. There are present two small, partially discrete denticles on left side of cusp. Cusp very large, heavy, tapering slightly to a rather blunt point. Three small, subequal, partially discrete denticles occur on right side of cusp.

Remarks: E. scotti differs from E. equilateralis in the much greater size of the cusp than the denticles. It resembles E. coronata (Stauffer and Plummer), but is much smaller and has a shorter cusp.

Length: .45 mm. Height of cusp: .90 mm. Av. Dent. Ht.: .32 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.
Holotype: Walker Museum No. 44638.

EUPRIONIODINA SCOTTI VAR. ACUTUS Jones n. var.

Plate I, Figure 15

Small dental unit; bar abruptly curved, bearing orally a large, acutely pointed cusp, broadly expanded at its base, flanked by two small, partially confluent denticles on each side.

Remarks: This form resembles quite closely E. scotti, with the exception of the cusp, which is longer and more acutely pointed.

Length: .42 mm. Height of Cusp: .89 mm. Av. Dent. Ht.: .20 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.1.
Holotype: Walker Museum No. 44639.

EUPRIONIODINA MINUTA Jones n. sp.

Plate I, Figure 16

Small, delicate form; bar essentially straight for the greater part of its length, curving at the anterior end at an angle of approximately 160 degrees. Bar bears orally three extremely

small, delicate, sharply pointed, discrete, sloping denticles anterior to cusp. Cusp slender, long, acutely pointed, discrete, sloping anteriorly. Posterior denticles are small, discrete, eight in number, lying parallel to the cusp.

Remarks: This form, characterized by its small size, resembles E. exserta (Stauffer and Plummer), save that the denticles are more acutely pointed and it is much smaller.

Length: .38 mm. Height of cusp: .21 mm. Av. Dent. Ht.: .13 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44640.

Genus HAMULOSODINA Cooper 1931

This genus more closely resembles Euprioniodina than any other of the described genera. It differs from this genus in that the downward projection of the bar is much more developed and does not carry denticulation along its entire length. In fact, the development of the projection below the bar is equal to or greater than the length of the cusp, usually continuing the curvature of the cusp without interruption, giving the tooth a decided pick-like appearance. The denticles which appear in front of the cusp, if they are present, are confined to the area immediately adjacent to the end of the bar.

HAMULOSODINA REGULARIS Jones n. sp.

Plate III, Figure 12

Large form; bar essentially straight, carrying a terminal cusp, which is followed by a series of large denticles two-thirds length of cusp, alternating with a series of smaller denticles in the approximate ratio of one to five. Smaller denticles have appearance of being inserted into the bar. Anticusp present, recurving sharply downward and inward, bearing four small, germ denticles on its oral margin.

Remarks: In the identification of these long denticulated bar types of conodonts, no generic identification was made unless the anterior end was present to determine whether or not the form possessed a definite anticusp. Many fragments were discarded because they failed to show the diagnostic feature necessary to distinguish between Hindeodella and Hamulosodina.

Length: .2. mm. Height of Cusp: .5 mm. Large Dent.: .4 mm.

Small denticles: .25 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.3.
Holotype: Walker Museum No. 44641.

HAMULOSODINA SPINOSA Jones n. sp.

Plate III, Figure 16

Medium-sized form; bar curving abruptly at posterior end, and produced anteriorly into a long antiscusp, which curves downward and inward, bearing a series of seven small, partially confluent denticles on its oral surface. Cusp long, narrow, sharply pointed, followed posteriorly by a series of very delicate slender denticles about three-fourths length of cusp, and alternating with smaller denticles in the approximate ratio of one to four.

Remarks: This form is characterized by the downward curve of the posterior portion of the bar, and by the exceedingly delicate nature of the cusp and denticles.

Length: .75 mm. Height of Cusp: .24 mm. Av. Dent. Ht.: .16 and .10 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.1.
Holotype: Walker Museum No. 44642.

HAMULOSODINA DELICATISSIMA Jones n. sp.

Plate III, Figure 20

Small, very fragile form; bar straight, with pronounced terminal cusp and sharply recurved, denticulated antiscusp which is equal in length of the cusp. Anterior cusp followed by a series of denticles alternating large and small in the ratio of one to three or four. Posterior denticles increasing in their slope to the bar.

Remarks: This species differs from H. regularis in its small size, flat bar, and in the slope of the denticles to the bar in the posterior portion.

Length: .51 mm. Height of cusp: .05 mm. Dent.: .025 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.
Holotype: Walker Museum No. 44643.

HAMULOSODINA DELICATISSIMA ELONGATA Jones n. var.

Plate III, Figure 23

This form differs from H. delicatissima in that it is a

bit larger, and, due to its greater length, possesses more denticles on its oral side.

Length: .85 mm. Height of cusp: .06 mm. Dent. Ht.: .029 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44644.

Genus HINDEODELLA Ulrich and Bassler 1926

Bar long and straight, bearing as many as ten denticles in front of the strong, long main cusp, and a long series of small slender denticles often alternating in size behind it; those of each set are approximately equal in size.

HINDEODELLA LATIDENTATA Jones n. sp.

Plate III, Figure 17

Medium-sized form; bar long, curving gently to the posterior, bearing six small, fused denticles anterior to cusp. Cusp long, narrow, acutely pointed, followed by a series of large, wide, acutely pointed denticles, with smaller, more slender, inserted denticles between. Large denticles about three-fourths length of cusp; small germ denticles arranged in a ratio of three to one large denticle.

Remarks: This species resembles several species of the same genus from the Mississippian, but differs in the greater length of the large denticles in relation to the length of the cusp.

Length: 2.1 mm. Height of Cusp: .4 mm. Av. Dent. Ht.: .25 mm. and .3 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc. 3.

Holotype: Walker Museum No. 44645.

HINDEODELLA SINUATA Jones n. sp.

Plate III, Figure 18

Extremely long, narrow form; bar sinuous, slender, subelliptical in cross-section, thickened at base, bearing a series of sloping, partially confluent denticles. There are ten denticles anterior to the cusp region. No definite cusp is present; denticles posterior to cusp region extremely fine, alternating in an irregular ratio of one to two, three, or four.

Remarks: This form is characterized by its gentle downward arching of the bar in the anterior one-third of its length. Occurs quite commonly in the Seminole.

Length: 2.5 mm. Height of denticles: .15 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.

Holotype: Walker Museum No. 44646

HINDEODELLA SINUATA FIGMEA Jones n. var.

Plate III, Figure 19

This form closely resembles H. sinuata, save that it is much smaller, and that the anterior portion of the bar is more strongly curved downward.

Length: 1.1 mm. Denticles: .085 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.1.

Holotype: Walker Museum No. 44647.

Genus EUPRIONIODELLA Jones n. gen.

This genus closely resembles Euprioniodina Ulrich and Bassler, but differs in that denticles do not occur on the anterior downwardly curved portion of the bar. The forms are usually smaller than species of Euprioniodina.

Genotype: Euprioniodella delicatissima Jones n. sp.

EUPRIONIODELLA DELICATISSIMA Jones n. sp.

Plate III, Figure 21

Small form; bar curves gently for greater part of its length, then it curves downward rather sharply beneath cusp. Cusp is terminal, long, slender, over twice length of denticles; posterior denticles rather broad, discrete for the greater part of their length, nine in number, decreasing in size and in slope to the bar toward the posterior.

Length: .55 mm. Cusp Height: 1.1 mm. Av. Dent. Ht.: .38 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44648.

EUPRIONIODELLA ? ROBUSTA Jones n. sp.

Plate I, Figure 6

Bar short, heavy, thickened basally; terminal cusp very heavy, robust, bluntly pointed, with definite pulp cavity below it, followed by a series of three long, slightly curved, discrete, more slender denticles.

Remarks: This form is doubtfully assigned to the genus

Euprioniodella, because of its terminal cusp, and because of its fragmentary nature, may have had more denticles posterior to those shown by the specimen.

Length: .6 mm. Cusp Ht.: 1.1 mm. Dent.: .45 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc. 1.

Holotype: Walker Museum No. 44649.

EUPRIONIODELLA ? SP. ?

Plate I, Figure 12

Cusp long, heavy, expanded at its base, slightly curved, with a rather blunt tip. Cusp followed by a series of three sub-equal, short, rather heavy, discrete denticles.

Remarks: This fragment was provisionally assigned to the new genus Euprioniodella, but no specific identification was possible.

Length: .38 mm. Cusp Ht.: .9 mm. Av. Dent. Ht.: .55 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc. 1.

Holotype: Walker Museum No. 44650

Genus OXYGONUS (Grubb 1932) Jones n. gen.

This genus is characterized by the curvature of the long bar at the anterior end, where it is curved downward abruptly to form a very acute angle. It differs from Euprioniodela in the small size of the denticles, and in the prolongation of the anterior portion of the bar. The genus was first discovered¹ by Grubb, who reported it from the coal measures of Illinois and who gave it its generic name. Although Grubb's manuscript has not been published, and although the form was independently discovered by the writer, it is here suggested that Grubb's name Oxygonus be used for the genus.

Genotype: Oxygonus multidentatus Jones n. sp.

OXYGONUS MULTIDENTATUS Jones n. sp.

Plate III, Figure 14

Bar long, gently curving for the greater part of its length, and sharply recurved beneath the cusp to form an angle of 60 degrees. Bar carries orally a long series of short, bluntly pointed, confluent denticles pointing toward the cusp, and inclined to the bar. Cusp long, narrow, flattened in cross-section, acutely pointed. Anterior denticles are smaller, sloping toward cusp, confluent.

¹Grubb, op. cit.

There is a definite pulp cavity present beneath the cusp.

Length: 1.95 mm. Cusp height: .35 mm. Av. Dent. Ht.: .19 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44651.

OXYGONUS GROSSUS Jones n. sp.

Plate III, Figure 15

Bar short; anterior recurved portion making an angle of 70 degrees with the rest of the bar; posterior portion of bar gently arcuate, bearing a series of partially discrete, sloping denticles; cusp large, slender, acutely pointed. Anterior denticles larger, ten in number, also sloping towards bar.

Remarks: Bar shorter than in O. multidentatus, and anterior portion making a less acute angle with the posterior portion of the bar.

Length: 1.64 mm. Cusp height: .4 mm. Av. Dent. Ht.: .24 mm.

Horizon: Seminole formation, Collinsville, Oklahoma, Loc.3.

Holotype: Walker Museum No. 44652.

Genus LONCHODINA Ulrich and Bassler 1926

Like Euprionioidina, but ends of bar more equal in length, and the entire bar strongly bowed, bent in two directions, one with the usual upward curve at the middle, and the other outwardly as seen in a basal view; denticles more irregular and farther apart. Main cusp sometimes not readily distinguished from the denticles.

LONCHODINA LIGONODINOIDES Jones n. sp.

Plate I, Figure 1

Large form; bar gently curved for most of its length, becoming abruptly downcurved at anterior end; basal flange present along entire length; bar surmounted orally by eight long, slender, acutely pointed denticles, widely spaced, and essentially vertical to the plane of the bar; the presence of a terminal cusp gives the form a shape similar to the genus Ligonodina, but there is no anti-cusp present. Cusp long, heavy, rather acutely pointed, sub-elliptical in cross section.

Length: 1.1 mm. Cusp Height: 1.3 mm. Av. Dent. Ht.: .65 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44653.

LONCHODINA EQUILATERA Jones n. sp.

Plate I, Figure 3

Large form; bar bent into a rough semicircular outline, with a basal flange present; left side of bar bearing four long, discrete, heavy denticles, slightly curved toward cusp, and with rather blunt tips; the first and fourth of these denticles are broken off. Cusp central, large, twice as heavy and almost twice as long as other denticles; more rounded in cross section, and rotated somewhat so that the keel comes into view; right side of bar surmounted orally by a series of six subequal, heavy, discrete denticles, which are more vertical to the bar than those on left side.

Length: Height of cusp: 1.2 mm. Dent. Ht.: .55 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44654.

LONCHODINA ? TRIDENTATA Jones n. sp.

Plate I, Figure 4

Bar short, carrying three long, slender, heavily built discrete denticles, which are curved toward the cusp at their bases. Cusp terminal, rotated at right angles to the others, with a definite keel, and is twice as long as other denticles.

Remarks: This peculiar form, is provisionally assigned to Lonchodina.

Length: .38 mm. Cusp height: 1.26 Av. Dent. Ht.: .71 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44655.

LONCHODINA ? HORRIDA Jones n. sp.

Plate I, Figure 7

Large, heavy heterognathid form; bar straight, flaring slightly at base; surmounted orally by a series of four long, curving denticles, which are quite heavy, founded at base, and tapering rapidly to an acute point. Cusp terminal, heavy, bluntly pointed; abruptly curved at its base until it lies almost parallel to the bar. Slight basal flare and pulp cavity present beneath cusp.

Remarks: This form is tentatively assigned to Lonchodina.

Length: 1.9 mm. Cusp height: 1.4 mm. Av. Dent. Ht.: .75 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.
Holotype: Walker Museum No. 44656.

LONCHODINA HORRIDA RECTUS Jones n. var.

Plate I, Figure 8

Large form; cusp large and heavy, denticles curving slightly toward cusp.

Remarks: Differs from L. horrida in the size of the cusp, and in that the denticles do not curve so much toward the cusp.

Length: 1.9 mm. Cusp Ht.: 1.4 mm. Av. Dent. Ht.: .83 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.

Holotype: Walker Museum No. 44657.

LONCHODINA GRACILIS Jones n. sp.

Plate I, Figure 5

Medium-sized form; bar bent sub-centrally at an angle of approximately 160 degrees; posterior portion of bar bearing fragments of five rather flat, slender, discrete, widely spaced denticles. Cusp central, possessing a definite keel on both anterior and posterior margins, and sharply recurved toward the posterior at about one-fourth its length; anterior denticles five in number, curving gently toward the cusp; anterior denticles slender, rather widely spaced. No escutcheon present.

Length: 1.4 mm. Cusp Ht.: 1.1 mm. Av. Dent. Ht.: .61 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44658.

Genus LONCHODUS Pander

Simple forms consisting of a basal bar, straight, on which are mounted orally a series of discrete, large, slender denticles, subequal in length.

LONCHODUS MULTIDENS Jones n. sp.

Plate II, Figure 11

Medium-sized form; bar straight, with definite basal flange, surmounted orally by a series of discrete, long, acutely pointed,

slender denticles, eighteen in number, increasing in verticality to the bar in the posterior portion.

Length of bar: .84 mm. Av. Denticles Height.: .21 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44659.

LONCHODUS DECKERI Jones n. sp.

Plate I, Figure 13

Extremely large form; fragmentary; bar straight, slight basal flange present; bar bears on its oral surface a series of seven long, slender, sub-elliptical, subequal denticles, with pronounced keels on both anterior and posterior lateral edges of denticles.

Remarks: This species is named in honor of Dr. C. E. Decker, Professor of Paleontology of the University of Oklahoma, under whose direction the preliminary work on this problem was done.

Length: 1.1 mm. Height of denticles: .44 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44660.

LONCHODUS INCLINATUS Jones n. sp.

Plate I, Figure 22

Medium-sized form; bar straight, with pronounced basal ridge, bearing on its oral surface a series of rather closely spaced, discrete acutely pointed denticles, increasing in slope to the bar posteriorly and also decreasing in length toward the posterior end.

Remarks: This species differs from other species of Lonchodus in that the denticles are shorter, more closely spaced, and not so parallel one with another.

Length: .86 mm. Average Height of denticles: .21 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.2.

Holotype: Walker Museum No. 44661.

LONCHODUS ? DIVERSUS Jones n. sp.

Plate I, Figure 13

Small heterognathid form, bar straight, no basal thickening; surmounted orally by a series of fine, slender, slightly

curved, acutely pointed denticles, which are discrete, and which increase in curvature toward posterior. Third denticle may be a cusp.

Length of bar: .20 mm. Denticle height: .06 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.3.

Holotype: Walker Museum No. 44662.

Genus GONDELLA Stauffer and Plummer 1932

Tooth-tongue, cano, or gondola shaped, with posterior end pointed; bar or base slender to thick and broad, usually keeled on aboral side; upper surface flat or slightly concave, usually covered by short transverse ridges, broken along the median line by a series of short, often stout denticles, which may become more prominent and more closely set near the posterior end. The denticles may be more or less fused to form a ridge or rim or carina. The anterior end is marked by a prominent denticle or forward-projecting cusp, which in some species is double pointed. Under side is smooth save for the keel, which usually had a median furrow bounded by slightly elevated ridges on both sides. These make a flaring loop anteriorly, but, in some species, converge and on some specimens disappear posteriorly. At the looped end the furrow distends into a cavity bounded by the lateral ridges.

GONDOLELLA QUADRATA Jones n. sp.

Plate III, Figure 25

Tooth large; median ridge or carina surmounted by ten more or less rounded, short, stout denticles, becoming smaller posteriorly; anterior terminal cusp somewhat indistinct but present; not tapering in outline, but more or less quadrate, sides almost equally parallel; aboral keel present, flaring anteriorly into a terminal cavity; blade short, broken off almost entirely in this specimen.

Length of Plate: 1.1 mm. Width of Plate: .49 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44663.

GONDOLELLA CUNEIFORMIS Jones n. sp.

Plate III, Figure 25

Form in outline wedge-shaped, axis of plate slightly curved; median ridge marked by eleven large, semi-confluent denticles, decreasing in size and becoming more discrete posteriorly; transverse ridges not so numerous, anterior end is truncated, forming a rough

triangular outline; terminal cusp low and broad at the base, rather sharply pointed.

Length of plate: 1.4 mm. Width of plate: .56 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44664.

GONDOLELLA OVATA Jones n. sp.

Plate III, Figure 26

This form is teardrop-shaped, with nine semi-spherical nodes on median carina; lateral ridges disappearing at base of the carina; outline of plate somewhat crenulated due to the lateral ridges which extend to the outer margins of the plate. Posterior denticles on carina slender, elongate, becoming blade like, and increasing in length.

Length of plate: .9 mm. Width of plate: .39 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44665.

Genus IDIOGNATHODUS Gunnell 1932

IDIOGNATHODUS CORRUGATUS GUNNELL 1932

The plate is in general outline lanceolate, with a series of ten transverse ridges crossing the flat oral surface of the plate; left posterior lobe bearing two rows of nodes, the outer of which are three in number and the inner one bearing two elongate, rounded nodes. Right posterior lobe with six more or less rounded nodes, with no definite orientation.

Remarks: Gunnell reported this form from the Cherryvale shale of Kansas.

Length of plate: 1.1 mm. Width of plate: .46 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.3.

Holotype: Walker Museum No. 44666

Genus STREPTOGNATHODUS Stauffer and Plummer 1932

Plate somewhat lanceolate, sub-symmetrical, with a deep axial furrow, toward which the eight or ten or more lateral ridges marking the upper surfaces, extend from each side, and into which they disappear. Usually shelf-like processes extend out from each side at the base of the plate and may bear nodes. A long and usually tapering bar extends from the basal end of the plate, and the denticles of its upper edge are fused throughout a greater part of their length, anteriorly decreas-

ing in prominence, and finally becoming a smooth-edged ridge or carina, which extends into the furrow and usually ends at some point between the base and middle of the plate. Under surface marked by a longitudinal groove bounded by ridges that flare out suddenly beneath the plate, expanding the groove into a wide cavity tapering to the pointed end of the plate.

STREPTOGNATHODUS NODOCARINATUS Jones n. sp.

Medium-sized Plate III, Figure 2

Medium-sized polygnathid conodont, plate sublanceolate, oral surface marked by a definite longitudinal groove, on each side of which the lateral slopes face inward and downward. Left side of plate marked by a series of seven pairs of nodes, sloping slightly to the posterior, right side of plate with seven lateral carinae, or ridges, in corresponding positions to the rows of nodes on the left side. Only a fragment of the bar is present, extending a short distance into the median groove. Left posterior lobe larger than right, bearing four nodes in a longitudinal series; right posterior lobe projecting posteriorly, bearing a linear series of four smaller nodes. Aboral escutcheon well-developed.

Length of Plate: 1.2 mm. Width: 4 mm. Length of bar: .36 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44667.

STREPTOGNATHODUS EQUALIS Jones n. sp.

Plate III, Figure 1

Rather large form; plate lanceolate, with a pronounced median groove; each side of plate bearing nine distinct carinae which are transverse to the axial line; anterior ridges sloping more toward the groove. Posterior three ridges on left side are really composed of two slightly elongated nodes; left posterior lobe large, bearing six nodes arranged in a triangular series, lateral margin of plate produced posteriorly in a thin, high ridge past the posterior margin of the plate; aboral side smooth, marked by a distinct escutcheon and lateral flare of edges.

Length of plate: 1.3 mm. Width of plate: .48 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.2.

Holotype: Walker Museum No. 44668.

STREPTOGNATHODUS EXCELSUS var. rectus. Jones n. var.

Plate III, Figure 3

Extremely large form: plate lanceolate to fusiform in outline; oral groove very prominent; this form differs but slightly from the form described by Stauffer and Plummer as S. excelsus. The principal difference lies in the straight axial furrow, and the fewer number of nodes on the left posterior plate.

Length of plate: 1.6 mm. Width of plate: .46 mm.

Horizon: Seminole formation; Collinsville, Oklahoma.Loc.2.

Holotype: Walker Museum No. 44670.

STREPTOGNATHODUS OBLIQUISULCATUS Jones n. sp.

Plate III, Figure 7

Medium-sized form; plate lanceolate in outline, sub-symmetrical, oral surface crossed by eight rather broad, well-defined transverse ridges, which are broken by the characteristic median or axial furrow; axial furrow in this species is not median, but extends from the posterior end at an angle of approximately ten degrees to the median line of the plate; posterior margins of the plate produced posteriorly into a pair of nodose ridges extending slightly beyond the posterior end; right posterior lobe, with one auxiliary node outside the line of nodes making it up; bar fragmentary, bearing a series of fused denticles which become less distinct anteriorly, and not extending into the median furrow.

Length of plate: 1.2 mm. Width of plate: .34 mm. Length of blade: 1.9 mm.

Horizon: Seminole formation; Collinsville, Oklahoma.Loc.1.

Holotype: Walker Museum No. 44671.

Genus BICARINODUS Jones n. gen.

Small polygnathid forms; plate long, narrow, consisting of main axis which is the anterior end of the blade or bar, and a secondary carina, confluent with the axial carina at anterior end; separated from it at an angle of 10 to 15 degrees; resultant furrow deep; nodes of anterior portion of blade extend unbroken into carina, which is surmounted orally by a series of elongate rather sharply pointed nodes; blade long, with wide, acutely pointed denticles which are almost entirely the same height in a given form. Aboral escutcheon well-developed, flaring out largely in some species. Bar over three times length of basal plate.

Genotype: Bicarinodus oherni.

BICARINODUS OHERNI Jones n. sp.

Plate III, Figures 8a and 8b

Small form; plate sub lanceolate, consisting of a primary carina which is continuous with the blade, and carrying five simple rather pointed, elongate nodes in a perfect linear series. Second carina lying on right side of the main axis, curving slightly to its junction with the axial carina at anterior end, and bearing on its oral surface a series of five elongate, semi-pointed nodes, whose tips do not reach the plane of the nodes of the main axial carina, but only about two-third the distance; blade long, rectangular in outline, bearing orally a series of twenty-three subequal, partially confluent, obtusely pointed denticles. Aboral surface with a definite escutcheon flaring more on left side of plate.

Remarks: The genotype is named for D. W. Ohern who first worked on the Pennsylvanian beds of northeast Oklahoma.

Length of plate: .95 mm. Width of plate: .26 mm. Length of blade: 1.4 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44672.

BICARINODUS BIFURCATUS Jones n. sp.

Plate III, Figure 10

Extremely large form; plate sub lanceolate, greatly elongated; axial carina a prolongation of blade, and bifurcating anteriorly into two branches each bearing two nodes; portion of axial carina posterior to this branching point bearing eight long, rather sharply pointed nodes; secondary carina bearing six nodes, more rounded, arranged on the axis which curves inward to meet the main axis at a point just posterior to the point of bifurcation anteriorly. Only a small fragment of the blade remains.

Length of plate: .74 mm. Width of plate: .38 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44672.

BICARINODUS EXPANSUS Jones n. sp.

Plate III, Figure 10

Medium-sized form; oral surface of plate bearing six, rather large, elongate, bluntly pointed nodes on axial carina; secondary carina making an angle of thirty degrees with axial plane; nodes indistinct, partially fused, but are reflected in the left side of the ridge where numerous poorly defined ridges, running transversely to where they intersect the main carina. On the left side of the axial carina there is one rather long, rather acutely pointed node sloping toward the anterior; aboral escutcheon well developed.

Length of plate: .24 mm. Width of plate: .38 mm.

Horizon: Seminole formation; Collinsville, Oklahoma, Loc.3.

Holotype: Walker Museum No. 44673.

Genus POLYGNATHUS Hinde (Bryan 1921)

Plate subsymmetrically lanceolate, transversed by a high median carina extending stalk like from the broader end and reaching, although diminishing gradually in height, to the opposite usually pointed end, dividing the plate into two lateral subequal areas. On the oral surface the summit of the carina carries a row of closely approximated nodes and the depressed sides of the plate are variously ornamented with nodes and ridges. The underside is smooth or with fine concentric lines.

POLYGNATHUS ? latus Jones n. sp.

Plate III, Figure 6

Small form, plate lanceolate, broadly expanded posteriorly; median carina surmounted orally by five, elongated, rounded nodes, which continue posteriorly as the denticles of the bar or blade; right lobe of plate carrying four large, fused, confluent, rounded nodes in a linear series; left side with only a crenulated ridge, both lateral ridges meeting the central carina at anterior end.

Length of plate: .38 mm. Width of plate: .26 mm.

Horizon: Seminole formation; Collinsville, Oklahoma. Loc.1.

Holotype: Walker Museum No. 44674.

REGISTER OF LOCALITIES

Locality No. 1. Section of the black shale exposed at the Brick Pit of the Coffeyville Vitrified Brick and Tile Company, in the southeast quarter of sec. 20,

Township 22 North, Range 14 East. Collinsville,
Oklahoma.

Locality No. 2. A long narrow coal pit north and west of the town
of Collinsville in the northwest one-quarter of
sec. 20, Township 22 North, Range 14 East.

Locality No. 3. A series of abandoned strip pits covering most of
sec. 32, Township 22 North, Range 14 East. A new
pit dug in the southwest quarter of sec. 32.

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Explanation Plate I

Illustrations X 30

1. LONCHODINA LIGONODONOIDES Jones n. sp.
2. BICORNOGNATHUS FREEMANI Jones n. Gen. n. sp.
3. LONCHODINA EQUILATERA Jones n. sp.
4. LONCHODINA ? TRIDENTATA Jones n. sp.
5. LONCHODINA GRACILIS Jones sp. n. sp.
6. EUPRIONIODELLA ROBUSTA Jones n. sp.
7. LONCHODINA ? HORRIDA Jones n. sp.
8. LONCHODINA HORRIDA VAR. RECTUS Jones n. var.
9. EUPRIONIODINA COLLINSIVELENSIS Jones n. sp.
10. EUPRIONIODINA LONGICUSPATA Jones n. sp.
11. LONCHODUS MULTIDENS Jones n. sp.
12. EUPRIONIO DARIA sp. ?
13. LONCHODUS DECKERI Jones n. sp.
14. EUPRIONIODINA SCOTTI Jones n. sp.
15. EUPRIONIODINA SCOTTI VAR. ACUTUS Jones n. var.
16. EUPRIONIODINA MINUTA Jones n. sp.

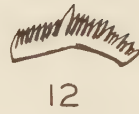
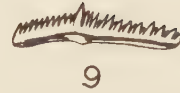
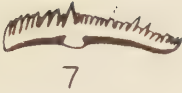
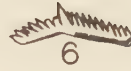
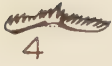
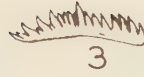
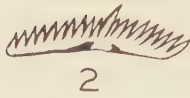
PLATE I



Explanation Plate II
Illustration X 30

1. BRYANTODUS SEMINOLENSIS Jones n. sp.
2. BRYANTODUS MAGNUS Jones n. sp.
3. BRYANTODUS PSEUDOALTERNATA Jones n. sp.
4. BRYANTODUS INCLINATUS Jones n. sp.
5. BRYANTODUS CURVATA Jones n. sp.
6. BRYANTODUS ANGULARIS Jones n. sp.
7. BRYANTODUS MULTIDENTATA Jones n. sp.
8. BRYANTODUS PSEUDOREGULARIS Jones n. sp.
9. BRYANTODUS ALTERNATUS Jones n. sp.
10. BRYANTODUS SYMMETRICUS Jones n. sp.
11. BRYANTODUS PARVA Jones n. sp.
12. BRYANTODUS ALTA Jones n. sp.
13. EUPRIONIODINA LATICOMPRESSA Jones n. sp.
14. EUPRIONIODINA RECTA Jones n. sp.
15. EUPRIONIODINA ACUTA Jones n. sp.
16. EUPRIONIODINA FRAGILIS Jones n. sp.
17. EUPRIONIODINA CRONEISI Jones n. sp.
18. EUPRIONIODINA EQUILATERALIS Jones n. sp.
19. EUPRIONIODINA SUBEQUALIS Jones n. sp.

PLATE II



Explanation Plate III

1. STREPTOGNATHODUS
2. STREPTOGNATHODUS NODOCRINATUS Jones n. sp.
3. STREPTOGNATHODUS EXCELSUS VAR. RECTUS Jones n. var.
4. IDIOGNATHODUS CONUGATUS Gunnell
5. IDIOGNATHODUS CONUGATUS VAR. Jones
6. POLYGNATHUS SP. ? Jones
7. STREPTOGNATHODUS OBLIQUISULCATUS Jones n. sp.
8. BICARINODUS OHERNI Jones n. gen. n. sp.
9. BICARINODUS EXPANSUS Jones n. sp.
10. BICARINODUS BIFURCATUS Jones n. sp.
11. LONCHODUS MULTIDENS Jones n. sp.
12. HAMULOSODINA REGULARIS Jones n. sp.
13. LONCHODUS REGULARIS Jones n. sp.
14. OXYGONUS MULTIDENTATUS Jones n. Gen. n. sp.
15. OXYGONUS GROSSUS Jones n. sp.
16. HAMULOSODINA SPINOSA Jones n. sp.
17. HINDEODELLA ? Jones n. sp.
18. HINDEODELLA SINUATA
19. HINDEODELLA SINUATA PIGMEA Jones n. var.
20. HAMULOSODINA DELICATULA Jones n. sp.
21. HAMULOSODINA DELICATA VAR. ELONGATA Jones n. var.
22. LONCHODUS INCLINATUS Jones n. sp.
23. HAMULOSODINA DELICATULA ELONGATA Jones n. var.
24. GONDOLELLA QUADRATA Jones n. sp."
25. GONDOLELLA CUNEIFORMIX Jones n. sp.
- 26, 26a. GONDOLELLA OVATA Jones n. sp.

PLATE III

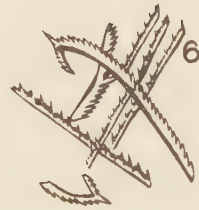
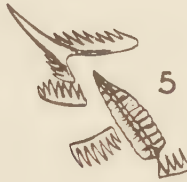
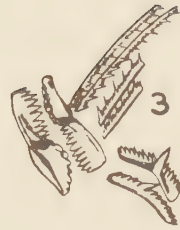


Explanation Plate IV

Illustrations X 30

1. Assemblage One
2. Assemblage Two
3. Assemblage Three
4. Assemblage Four
5. Assemblage Five
6. Assemblage Six
7. Assemblage Seven
8. Assemblage Eight
9. Assemblage Nine
10. Assemblage Ten
11. Assemblage Eleven
12. Assemblage Twelve
13. Assemblage Thirteen
14. Assemblage Fourteen
15. Assemblage Fifteen

PLATE IV



13



15



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